Saskatchewan
Agriculture
and Food

Seed treatments and foliar fungicide sprays for cereal, oilseed, forage and pulse crops, 1991

92-06000/

Table of Contents

Seed Treatment 3

Seed Treatment Costs 3

Seed Treatment Notes
- **Cereals - Seedling Diseases** 3
- **Cereals - Smuts** 3
- **Cereals - Wireworms** 3
- **Oilseeds - Seedling Diseases** 3
- **Oilseeds - Blackleg** 3
- **Oilseeds - Flea Beetles** 3
- **Forage Crops** 3
- **Pulse Crops** 4

Methods of Seed Treatment 4

General Precautions 4

Foliar Fungicide Sprays 5

Leaf & Stem Diseases of Wheat
- **Leaf Rust** 5
- **Stem Rust** 5
- **Stripe Rust** 5
- **Septoria Leaf Spot** 5
- **Tan Spot** 5
- **Powdery Mildew** 5

Leaf Diseases of Barley
- **Net Blotch** 5
- **Scald** 5

General Disease Control for Cereals 5

Sclerotinia Stem Rot of Canola 6

Table 1: Seed Treatment Products for Use on Cereals and Oilseeds 12

Table 2: Foliar Fungicide Products for Use on Cereals and Oilseeds 13

Fungicide Product Information

Anchor 6
Bayleton 50 W 7
Benlate 8
Benolin-R 8
Captan Flowable Seed Treatment 8
Dithane M-45 9
Formalin 9
IPCO N-M Drill Box 10
IPCO N-M D.P. Drill Box 10
Premiere Flowable 10
Rovral Flo 11
Rovral ST 11
Thiralin Plus 8
Thiram 75 WP 14
Thiram 320 Flowable 14
Tilt 250 E 15
Vitavax Dual Powder 15
Vitavax Dual Solution 16
Vitavax Powder 17
Vitavax RS Flowable 17
Vitavax RS Powder 18
Vitavax Single Solution 18

This publication is intended to be used as a guide only. The information presented here should be applicable to most situations if recommendations are followed carefully. Brand names used are included for convenience. Their use does not imply endorsement by the authors or the department.

While every effort has been made to ensure accuracy, Saskatchewan Agriculture and Food does not accept any responsibility for errors in conversion or otherwise. Consult product labels for final detailed instructions before using product.

List of Fungicides For Use on Cereal, Oilseed, Forage and Pulse Crops, 1991.

The following is a list of pest control products registered for seed treatment or foliar application as of January 1991 and available in Saskatchewan. These products are available from farm supply dealers, seed plants and elevator companies. This does not constitute in any way a recommendation of specific products over any others that may be registered for the purposes claimed.

Seed Treatment

Seed treatments are available that contain fungicide for disease control, insecticide for insect control, or fungicide and insecticide (dual purpose products). See table 1 for a list of seed treatments and their registered uses.

Formulations for seed dressings include dusts, wettable powders, solutions and flowables. These may be applied by seed-treating equipment or in the case of some products, in the drill box with the seed at the time of seeding. Slurry and liquid treatments reduce exposure for the operator and give better seed coverage.

Seed treatment with fungicide effectively controls some seed-borne diseases and also may give some protection against seed decay and seedling blight. Selection of the correct treatment is important since different treatments may control different diseases. Choice of product will depend upon the kind of seed to be treated, disease or insect to be controlled, and preference for type of formulation.

Disease organisms may be carried on the seed surface, within the seed or as contaminants in debris with the seed. Discolored or shrivelled seed may be an indication of seedborne disease (eg. blackpoint) but many diseases are not visible and seed may appear healthy (eg. loose smut).

Fungicides are either systemic (eg. carbathiin) or protectant (eg. maneb, thiram). Protectant fungicides provide control of diseases carried on the seed surface such as covered smut and bunt as well as seedling blights. Systemic fungicides also control these diseases, with the addition of loose smut. A seed disinfectant such as formaldehyde provides control of covered smuts but does not control loose smut or soil-borne seedling blights.

Seed Treatment Chemicals are Poisonous

Read the product label carefully since it shows the purpose for which the chemical is sold, directions for use, and handling precautions.

Seed Treatment Costs

Seed treatment provides protection from disease and insect damage at a reasonable cost. Typically, wheat and barley can be fungicide treated for less than $2.50 per hectare ($1 per acre), and dual-purpose treated for less than $4.95 per hectare ($2 per acre). Canola seed may typically be treated at a cost of $4.95-$7.40 per hectare ($2-$3 per acre). Costs quoted vary according to seeding rate selected and product used.

Seed Treatment Notes

Cereals

Seedling diseases - Seed treatment promotes good seedling growth, and helps to improve seedling vigour, especially where frost injured seed is used. All winter cereals and the hulless barley varieties Scout and Tupper require protection and their treatment with fungicide is strongly recommended. Seedlings which develop from treated seed are better able to resist certain root rots.

Smuts - The smuts that attack wheat, barley, oats and rye may be controlled by chemical seed treatments. When smut is observed in a crop to be subsequently used for seed, the seed should be treated. If the presence of smuts is uncertain, it may be a wise precaution to treat seed of susceptible varieties. Varieties rated "Poor" in the Saskatchewan Agriculture publication 'Varieties of Grain Crops For Saskatchewan' should be treated every second year. Varieties rated "Very Poor" should be treated every year.

Pedigreed barley seed is tested for true loose smut content by Agriculture Canada Plant Products Division, Saskatoon (phone 975-4240) and must meet specified tolerances.

Pedigreed seed of resistant varieties, as well as seed of susceptible varieties that is free from true loose smut, should not require treatment for the disease. However, it may require treatment for covered and false loose smut. True loose smut of wheat and barley is harboured within the seed and may only be controlled by systemic fungicides, which are carried via conducting tissues in the stem up to the developing grains. The only systemic fungicide currently available for true loose smut is carbathiin (Vitavax, Anchor).

Covered smut and false loose smut spores are borne on the outside of the seed and may be readily controlled by non-systemic seed treatments.

Wireworms - Insecticide treatment of cereal seed for wireworms is only necessary if the pest occurred in a previous crop in the same field or if the area to be cropped was previously in sod. Two consecutive years of treatment are required to ensure adequate control.

Oilseeds

Seedling diseases - All flax seed should be treated with a fungicide to protect against seed decay, damping-off and seedling blight. Canola and mustard seedlings infected early with damping-off and which survive this initial damage are liable to later develop root rot. Fungicide treatment of canola and mustard seed is recommended to protect the seedling during establishment. This will permit the plant to better resist subsequent infections.

Blackleg - A more virulent strain of the disease is now generally distributed through the canola-growing region of Saskatchewan. Seed treatment with a fungicide is strongly recommended to reduce the risk of introducing the disease to unaffected areas. Seed treatment will not protect post-seedling plants from airborne spores.

Flea beetles - To protect seedling canola and mustard crops, use of an in-furrow application of granular insecticide along with the seed, or a seed treatment containing insecticide, is recommended. These afford flea beetle control for a limited period after seedling emergence.

Forage Crops

Treatment of alfalfa seed with thiram fungicide is no longer mandatory, provided it is free of **Verticillium albo-atrum**. A seed testing service is available to determine whether seed is infected with the Verticillium wilt fungus. One lb. samples may be sent to: Laboratory Services Division, Seed Borne Diseases Unit, Building No. 22 Central Experimental Farm, Agriculture Canada, Ottawa, Ontario K1A 0C6. There is a $29 fee for each

sample tested. Seed testing or thiram treatment is advisable if the presence of Verticillium wilt in a seed lot is uncertain. Alfalfa seed treatments include Thiram 75WP, ◆ (Uniroyal) and Thiram 320 Flowable ◉ (Uniroyal).

Damping-off, seed decay and seedling blights in the forage grasses may be controlled by the fungicide Thiram 75WP, ◆ (Uniroyal).

Pulse Crops

Pea and field bean seed treatments registered for use against seed decay, seedling blight and damping off include captan and thiram.

Recent research data from Saskatchewan and Alberta indicate that seed treatment of peas with presently registered fungicides is inconsistent in improving emergence. When planting into cold, wet soils, seed treatment may provide some benefit.

There is no registered seed treatment for control of ascochyta blight on pulses.

Methods of Seed Treatment

Seed treatment may be done on farm prior to seeding or at seeding time.

Treatment before seeding: This may be done in batch treatment systems, such as in a cement-mixer, or in continuous flow systems, as in commercial seed treatment equipment. The manufacturer's directions should be followed for rate of product application. In general, seed should be treated as shortly before seeding as possible and, if it has to be stored, it should be kept in cool, dry conditions. Refer to product labels for limitations on storage of treated seed.

Treatment at time of seeding: Almost all formulations of chemicals can be applied at this time. Drill-box powders are usually mixed with the seed in the drill-box. Follow the manufacturer's directions. Mix seed and treatment product with a paddle, wear rubber gloves, and a good dust mask over the nose and mouth. Thorough mixing is important, since uniform application is essential for good results.

When canola is to be treated with a powder product, a non-detergent vegetable oil (such as canola oil) should be applied to the seed to adhere the powder. Refer to these product labels. This practice is not necessary with flowable canola seed treatments.

Special powder and liquid metering devices are available and these treat seed being augered into a truck or drill-box.

Solutions can also be applied with an inverted sling bottle drip system or a 10 litre pump which meters liquid at the grain auger. There is also a treater device available for liquid formulations which attaches to hydraulic drill fill pumps.

Coated Seed

Coated canola seed is a commercially available product which minimizes user contact with seed treatment chemicals. Seed coating involves the application of a commercially available canola seed treatment followed by a film coating of adhesive material or sealant to the outside of the seed. Coated seed is also available with an additional layer of phosphorus fertilizer.

Examples of coated canola seed products include: GuardCoat (Grow Tec Ltd.) and Can-O-Gard (Canadian Seed Coaters Ltd.), containing a seed treatment with an adhesive film coat; GuardCoat Plus (Grow Tec Ltd.) and Can-O-Cote (Canadian Seed Coaters Ltd.), containing a seed treatment and triple superphosphate with an adhesive film coat.

Major advantages of using coated seed are improved convenience and user safety. Coated seed ensures that the user does not come into contact with seed treatment chemicals. Coating increases the size of the seed, making control of seeding rates simpler and affording increased precision in seed placement with most seeding equipment. The seed size is increased more with the fertilizer coating than with the film coating, the actual increase being noted on the attached seed bag tags. Coated seed is not dusty.

Coated forage legume and grass seed are also available. Forage legumes are pre-inoculated with Rhizobium fungi incorporated in the phosphate coating. The pre-inoculated alfalfa is commercially available with the fungicide Thiram on special order from the seed coating companies.

General Precautions

1. Always read the product label carefully and follow all directions when handling seed treatment chemicals. Most are highly poisonous.

2. Always follow the manufacturer's directions as to application rate. Overtreatment may kill the seed, and undertreatment will not adequately control the disease.

3. Care should be taken when mixing treated seed with granulars such as fertilizer or insecticide to ensure that the seed treatment is not removed. The abrasiveness of such mixing can be minimized by mixing more slowly and for shorter periods of time.

4 Do not use treated seed for food, feed or malting purposes. Treated seed must not be allowed to comtaminate grain delivered to an elevator used for feed. This means cleaning out bins and truckboxes before using them for other purposes. Surplus treated seed should be kept in a dry, locked storage. Treated seed carried over for use in the ensuing year should be mixed with freshly-treated seed of the same variety. The mixture should then be planted at the normal seeding rate. If desired, surplus treated seed may be disposed of by burial. Care should be taken to prevent exposure of treated grain to wildlife.

5. The Canada Seeds Act requires that any grain seed treated with a poisonous substance and offered for sale should be stained a conspicuous colour and labelled "Poisonous; do not use as food or feed. This seed has been treated with (name of poisonous substance)".

6. Container Disposal. Under the Pesticide Container Disposal Program, many rural municipalities have sites to which metal or plastic containers may be delivered for proper disposal. Disposal of other containers, and (where preferred) on-farm metal container disposal, should conform to the following guidelines.

Containers should be emptied as completely as possible when treating seed. Puncture and crush empty containers to render them useless for any other purpose and to facilitate burial. The burial site should be an uncropped area away from wells, ponds, streams or livestock feeding areas. There should be no runoff and the water table in the area should be at least three metres below the soil surface. Bury containers at least 40 cm below the surface. Compact the backfill to retard seepage. Mark or record the disposal site location.

Foliar Fungicide Sprays

Several fungicides are now registered for use on wheat, barley and canola as foliar sprays, to protect against diseases such as leaf spots, rust and Sclerotinia stem rot.

The fungicides which are presently available for foliar application to wheat and barley have been registered for use on a temporary (year to year) basis. Their registration status was not yet certain at the time of printing. These fungicides are intended for use by growers who utilize intensive cereal management techniques for high yield and quality.

Before deciding whether or not to use a fungicide spray, the cost of the product plus application should be balanced against disease potential, crop yield potential and the market price of the crop.

Always follow label instructions when applying fungicides, and observe the preharvest interval (number of days before harvest during which the chemical cannot be applied). Correct timing of fungicide sprays to the proper growth stage of the crop is often critical in obtaining disease control.

The following diseases may be controlled by fungicide sprays. Table 2 indicates registered uses of individual products.

Leaf & Stem Diseases of Wheat

Leaf rust appears as yellow to orange, small round to oval, slightly raised spots on leaves and leaf sheaths. As plants ripen, the rust pustules darken and appear black. Leaf rust does not overwinter in Saskatchewan. Spores must be carried in on winds from the United States each year.

Stem rust is similar in appearance to leaf rust, but is more confined to the stems. Pustules are reddish-brown and turn black as the plant ripens. Stem rust can be very damaging on susceptible varieties in some years.

Spores must be carried into Saskatchewan each season on winds from the south.

Stripe rust has caused problems in Alberta in recent years on soft white wheat. Pustules are yellow and may extend the entire length of the leaf blade. Late in the season pustules turn dark brown. Spores are carried by air currents into Canada.

Septoria leaf & glume blotch is widespread in Saskatchewan. Symptoms appear as yellow flecks on leaves, which expand into lens shaped or elongated brown lesions. Glume infections appear as purplish-brown to grey blotches. Dark pycnidia (pin head sized spore producing structures) form inside the leaf spots and on the glumes. The fungus overwinters on wheat straw or stubble, and spreads by rainsplash or airborne spores.

Tan spot is a common disease of wheat in Saskatchewan. Symptoms appear as small tan-brown flecks on the lower leaves, which expand into tan, irregular lens shaped lesions about 5-13 mm long. The leaf spots often have a darker center and may be surrounded by a zone of yellow. The fungus overwinters on wheat straw and stubble, and spreads by airborne spores.

Powdery mildew can be a problem on winter wheat and soft white spring wheat. Small grayish-white, powdery patches appear on lower leaves or stems. Eventually leaves and leaf sheaths may be covered with a whitish powdery growth. Small black specks (spore producing structures) later appear in the white fungal growth. Powdery mildew overwinters as mycelium on winter wheat, or on wheat stubble or straw.

Leaf Diseases of Barley

Net blotch symptoms appear as brown spots on leaves, which develop into longitudinal streaks. Lesions may take on a net-like appearance, or they may appear in a spot form. Leaf tissue surrounding the lesions may yellow, and entire leaves may die. Net blotch overwinters on barley straw or stubble and can also be carried in seed. This can be a damaging disease under wet or rainy conditions.

Scald appears as oval, grayish-green leaf spots, from 1 to 1.5 cm long. The central tissue becomes straw coloured, while the outer margins remain a distinct dark brown. Scald also overwinters on diseased barley stubble or straw.

General Disease Control for Cereals

Most leaf diseases are favoured by moist conditions such as frequent rains and high humidity. Powdery mildew is favoured by drier weather.

Whether or not fungicides are used as a disease management tool, cultural control practices can be beneficial.

1. Grow resistant varieties when available. Refer to the annual publication "Varieties of Grain Crops for Saskatchewan".

2. Practice crop rotation. Continuously growing one crop on the same land allows diseases to build up to damaging levels. A break in cereal production will allow infected stubble to decompose, thus reducing the amount of disease the following year.

3. Incorporation of stubble into the soil will hasten decomposition and minimize spread of diseases from infected straw. This may be contrary to soil conservation practices in many areas.

4 Practice shallow seeding. Deep seeding favours root rot and seedling blight, which may weaken plants making them more suceptible to other diseases.

Sclerotinia Stem Rot of Canola

Sclerotinia stem rot is a serious disease of canola that is widespread throughout the canola growing areas of Western Canada. It is caused by a fungus known as Sclerotinia sclerotiorum. Yield losses rarely exceed 20-25%, however, losses of 60% have been recorded. Yield reductions are due to premature ripening, lodging, shattering of pods and shrivelled seed.

Symptoms:

Infections begin as a soft, watery rot on leaves and stems. Lesions frequently girdle stems completely, resulting in wilting and premature death. By maturity, infected areas of the stem dry out and appear white in colour, often with zonate markings. The fungus produces hard, black sclerotia (fungal storage structures) in the hollow centres of infected stems. The white, infected stem tissue eventually shreds, releasing sclerotia into the soil. Diseased plants can often be spotted as prematurely ripened, straw coloured plants, contrasting with healthy green plants in a mature field.

Disease Cycle:

The fungus survives in soil or seed as sclerotia, which germinate under moist conditions to form tiny mushroom-like apothecia. The apothecia produce spores which become air-borne and have the potential to infect susceptible plants. The mid to late flowering stage of the crop is the most critical period for infection. The spores do not infect canola stems directly. They first infect the flower petals, which fall and often land on canola leaves, leaf axils or stems. The fungus then grows out of the petal and penetrates the plant. There it continues to grow and invade healthy tissue. Sclerotia are eventually produced in diseased tissue, and are released into the soil at harvest. Sclerotia are capable of surviving up to 5 years or more in soil under Saskatchewan conditions.

Moisture is necessary for the production of apothecia and infection of canola plants. A heavy crop canopy favours infection, as do frequent rains or heavy dews at the mid to late flowering stage. A dry spell during flowering can greatly reduce the damage caused by this disease.

Cultural Control:

For effective management of Sclerotinia, cultural control recommendations should be followed, even when using fungicide sprays. Cultural control recommendations also help to manage other serious canola diseases such as blackleg.

1. Allow at least 4 years between susceptible crops such as canola, mustard, field pea, fababean, lentil, sunflower, alfalfa, clovers and potatoes. Cereals and grasses are immune and will allow a reduction of viable sclerotia through decay in the soil and germination in the absence of a susceptible host.

2. Control volunteer canola and susceptible weed species.

3. Use cleaned seed, free of sclerotia. Sclerotia can be removed by using a spiral cleaner.

4. Do not sow canola adjacent to a field in which a heavily infested crop was grown in the previous year.

5. In severely infected fields, early swathing may reduce losses due to shattering.

Chemical Control:

Benlate 50% WP and Rovral Flo are both registered for use as foliar sprays against Sclerotinia stem rot of canola. See product information for more detail.

Fungicide Product Information

Anchor

Registrant: Gustafson

Active Ingredients: Carbathiin 66.7 g/L, thiram 66.7 g/L

Formulation: Liquid drill box treatment

Registered Use Claims and Treatment Rate:
Dosage Rate: mL/25 kg seed

Wheat - Loose smut, bunt, suppression of root rots.	200
Barley - False Loose, Covered and True Loose Smut, suppression of leaf stripe, net blotch and root rots	200
Oats - Loose and covered smut	200
Flax - Damping-off, seed decay	300
Rye - Stem smut, seed decay, damping-off	200
Triticale - Damping-off, seedling blight and seed decay	200
Soybeans - Penicillium and Aspergillus storage molds; Diaporthe and Phomopsis seed decay; Rhizoctonia species; seedling blights and seed rot. Control of these diseases,when present, can result in increased germination, emergence and yield	150

Anchor will generally increase emergence and plant stands of wheat, oats and barley by reducing seed-borne seed rots and seedling blights.

Application Notes:

Anchor is applied to the seed in the drill or planter box. Anchor is a flowable and non-dusty. It adheres to the seed and will not cause build-up in the drill or planter box which restricts the flow of seed. See label for details.

Restrictions:

1. Keep hopper box and seed drill lids closed during seeding to prevent dust and dirt from sticking to seed.
2. Stir Anchor - treated seed vigorously if the seeding operation has been interrupted for several hours or overnight. This will ensure a uniform seed flow.
3. Unit planters equipped with monitoring devices may be interrupted with any foreign material such as seed debris, dust, or seed treatments.
4. Seeding rate can be affected by seed treatments. Seeding rates should be checked at the beginning at the seeding operation and adjustments made accordingly.
5. Mix Anchor well prior to use by shaking container.
6. Do not apply Anchor through commercial seed treating equipment or through an auger as excessive seed wetness may result.
7. Anchor must be evenly and thoroughly distributed on the seed to achieve adequate disease control.
8. Leftover treated seed should not be stored, but should be double-sown around the headland.
9. Seed treatment has the potential to reduce the flow of seed through equipment at a given setting compared with untreated seed. Always recalibrate before planting Anchor-treated seed.

Precautions:

1. When handling Anchor and Anchor-treated seed, it is a good practice to work in a well-ventilated area and wear rubber gloves. Leather and cloth gloves are not recommended.
2. As Anchor is an eye irritant, protective eyewear should be worn when handling this product.
3. Do not mix with bare hands.
4. Keep out of reach of children.
5. Because of possible unpleasant side-effects, alcoholic beverages should be avoided for 24 hours before or after working with Anchor or Anchor-treated seed.
6. Use good personal hygiene, washing hands and exposed skin before eating, drinking or smoking. No food, drink or tobacco should be allowed in areas of chemical storage or use.

Storage:

Do not store Anchor above 35°C or below 0°C or in direct sunlight. Store in a cool, dry, ventilated place away from feeds and foods. Do not store in or around the home.

Other:

Seed Treatment and Inoculum Sticker: (Soybeans only) Anchor's unique liquid properties enable this product to perform as a sticker for inoculants. Anchor is safe to the nitrogen fixing bacterium, Rhizobium japonicum, found in peat and granular inoculants. Anchor plus inoculum applied at planting provides disease protection and root nodulation.

Seed treated with Anchor will remain damp for a period of time following treatment. This enables inoculant added to the hopper box or seed drill to adhere uniformly to seed, thus ensuring adequate nodulation of soybean seedlings.

Bayleton 50 W

Registrant: Chemagro

Active Ingredient: Triadimefon 50% Wettable Powder

Registered Uses:

Winter wheat: controls powdery mildew, leaf rust, stem rust, stripe rust
Note: In 1989 Bayleton had a temporary restricted class registration. Registration status for 1990 was not yet established at the time of publication. Check current status before using.

Dosage: 250-550 g/ha (100-225 g/acre)

Water Volume: Ground application: 100-300L/ha (10-30 gal/acre)

Use the higher spray volume where crop foliage is dense.

Application and Timing: Apply in a uniform broadcast spray to foliage when disease symptoms first appear. Additional applications should be made if new disease symptoms appear. For areas where severe rust or powdery mildew infections are expected, applications of 400 to 550 g/ha may be required.

Complete coverage and thorough application are essential for effective disease control.

Restrictions:

Do not apply within 60 days of harvest.

Do not feed forage to cattle. The total amount of product applied must not exceed 1.1 kg/ha (445 g/acre) per crop season.

Precautions:

Use only according to label directions. Do not use on any crop not specified on label. To protect fish and wildlife, do not contaminate streams, lakes or ponds. Do not breath dust or allow to get in eyes, on skin, or on clothing. Wash hands, arms and face thoroughly with soap and warm water after use and before eating or smoking. Wash all contaminated clothing with soap and hot water before reuse. Do not contaminate feed or food items. Keep out of reach of children.

Storage:

Do not allow the water soluble packets to become wet prior to mixing.

Mode of Action:

Triadimefon 50% WP provides protective activity by preventing completion of the infection process. It acts curatively by preventing disease symptoms after infection has taken place and it acts eradicatively to control disease after symptoms have appeared.

Triadimefon is quickly taken up by plants and translocated systemically in the young growing tissues. Because of its systemic activity, Triadimefon is less affected by adverse weather conditions, such as rain, than contact-type fungicides.

Benlate Fungicide

Registrant: Dupont

Active Ingredient: Benomyl 50%

Formulation: Wettable powder

Registered Uses:

Canola (rapeseed): controls stem rot (Sclerotinia sclerotiorum)

Note: Benlate is also registered for use on fruit, vegetables and ornamentals for control of various diseases. See label.

Dosage: 1.0-1.5 kg/ha (0.4-0.6 kg/acre).

Water Volume:

Ground Application: Minimum 80-100 L water/ha (32-40 L/acre). Apply with a high clearance boom, using cone nozzles or disc core cone nozzles tips.

Aerial Application: Use a minimum of 40L water/ha (16 L/acre).

Application and Timing:

Apply Benlate during the 20-30% bloom stage. This will usually be 4 to 7 days after first blossoms appear in the field. The 20-30% bloom stage corresponds with 15-20 flowers open on the main stem of Brassica napus (Argentine) varieties, or 11-15 flowers open on the main stem of B. campestris (Polish) varieties.

To allow thorough spray penetration to the lower stems and leaf axils, sprays should be completed before the crop canopy closes in. Late bloom stage applications (50% bloom or later) do not provide best yield or seed quality.

Precautions:

Keep out of reach of children. May irritate eyes, nose, throat and skin. Avoid breathing dust or spray mist. Avoid contact with skin, eyes and clothing. In case of contact, flush skin or eyes with plenty of water. For eyes get medical attention. Keep away from fire or sparks.

Storage:

Never allow Benlate to become wet during storage. This may lead to chemical changes which reduce effectiveness as a fungicide. Keep container closed when not in use.

Mode of Action: Contact and systemic fungicide.

Benolin-R
Thiralin-Plus

Registrant: Interprovincial Co-op, Rhone-Poulenc Canada Inc.

Active Ingredient: Benolin-R Thiralin Plus

Benomyl	6	6
Thiram	10	10
Lindane	50	75

Formulation: Dust

Registered Use Claims:

Canola: seed rot and seedling blight, damping off, seedborne, blackleg, flea beetles.

Dosage:

Benolin-R: 800 g/25 kg seed; Thiralin-Plus: 750 g/25 kg seed

Application Notes:

Drill box treatment. See label for more details. Note: Thiralin-Plus label states that a commercial drum or auger dust seed treater or cement mixer are suitable and are recommended over drill box treating.

Restrictions Label all unplanted, treated seed as follows: "Poisonous to man and animals. This seed has been treated with Benomyl and Thiram fungicides and Lindane Insecticide for the control of diseases and insects. Do not use as food or feed. Do not use seed for oil processing."

Do not use Benolin-R on soil in which edible root crops (except rutabagas and turnips) are to be planted during the same season or the following season.

Precautions:

Read label before using. Keep out of reach of children. May cause irritation of nose, throat or skin and may be harmful if swallowed or inhaled. Avoid contact with eyes, skin or clothing. Wash after using. In case of contact, flush with plenty of water. For eyes, get medical attention. Do not breathe the dust. Use a dust mask. Do not handle Benolin-R or Thiralin-Plus or treated seeds with bare hands.

Storage:

Keep package or dust away from fire or sparks. Do not allow product to become wet during storage.

Captan Flowable Seed Treatment

Registrant: ICI Chipman

Active Ingredients: Captan 30%

Formulation: Suspension

Registered Use Claims:

Peas, beans (snap, dry, lima), soybeans, field and sweet corn, sugar beets: Protects seed from storage rot in storage and after planting from seed decay, damping off and seedling blights.

Dosage:

Peas, beans, soybeans:	70 ml/25 kg seed
Corn:	30-85 ml/25 kg seed
Sugar beet:	155 ml/25 kg seed

Application Notes:

Mix the recommended amount of Captan Flowable with the amount of water required for the slurry treater equipment to be used. Allow seed to dry before bagging.

Precautions:

Keep out of reach of children. Do not inhale dust. Avoid contact with skin and eyes. Do not contaminate ponds, streams or other bodies of water. Wash with soap and water after using. Label treated seed "Poisonous: do not use as a feed, food or for oil processing. This seed has been treated with captan."

Dithane M-45

Registrant: Rohm & Haas Company Inc.

Active Ingredient: Mancozeb 80%

Formulation: Wettable Powder

Registered Use Claims:

Wheat (all varieties): controls tan spot, Septoria leaf diseases and leaf rust.

Note: Dithane M-45 was registered for us on wheat on a temporary basis for 1989. At the time of publication, registration status for 1990 was not yet established. Check current status before using.

Note: Dithane M-45 has full registration on numerous fruit and vegetable crops, including potatoes (see label).

Dosage: Wheat: 2.25 kg/ha (0.9 kg/acre) x 2 applications

Water Volume: Ground Application: 100-200 L/ha (10-20 gal/acre)

Aerial Application: 40 L/ha (4 gal/acre)

Application and Timing:

The first spray should be applied when the flag leaf has fully emerged (Feekes scale 10, Zadoks scale 47) but before there is more than a trace of disease on it. The second spray should be applied 7-10 days later as the head appears.

Dithane M-45 is a protectant fungicide (no systemic action). Good coverage is essential.

Restrictions:

Do not apply within 40 days of harvest. Do not feed straw or screenings to livestock. Do not make more than 2 applications during the season.

Precautions:

Keep out of reach of children. May cause irritation of nose, throat, eyes and skin. Do not breathe dust or spray mist. Avoid contamination of water supplies. This product is toxic to fish. Do not apply when weather conditions favour drift from treated areas.

Storage:

Keep away from fire or sparks. Do not allow product to become wet or overheated in storage, as this may generate flammable vapours.

Mode of Action:

Dithane M-45 is a protectant fungicide and, because of this, it is important to spray plants before disease becomes severe.

Formalin

Registrant: United Agri Products

Active Ingredient: formaldehyde 37%

Formulation: solution

Registered Use Claims:

Barley - covered smut
Wheat - bunt
Oats (except hulless) - loose and covered smut
Potatoes - black scurf, Rhizoctonia, common scab

Dosage: Barley, wheat & oats - 37 mL/25 kg seed
Potato - see label

Water Volume: barley, wheat - 300 ml formalin/100 L water
oats - 50% formalin: 50% water

Application notes: For treatment of wheat or barley, pile grain on floor and mix with formalin/water solution until grain is wet. Cover for 4 hours or overnight. Sow as soon as possible. If smut balls are present, immerse grain in solution for 5 minutes. Stir and skim off smut balls. For smut in oats, spray the seed using 50% formalin and 50% water. Turn the grain over a few times while spraying. Cover for 3 to 5 hours or overnight. Sow as soon as possible.

Precautions:

Wear a gas mask and gloves. Work in a well ventilated area. Avoid exposure to fumes and contact with skin, eyes and clothes. Keep away from heat, fire and sparks. Keep out of reach of children. Causes irritation of skin, eyes, nose and throat. Wash with soap and water after handling and before eating, drinking or smoking. Do not contaminate food, feed or any body of water.

Storage

Keep containers tightly closed, away from fire and sparks. Do not freeze. Minimum storage temperature is 15%dgC. Store in a dry ventilated place, away from food and feed.

Mode of action:

Formaldehyde is a bactericide and fungicide, used as a soil fumigant and seed treatment, although the latter use is limited by phytotoxicity.

IPCO N-M Drill Box

Registrant: Interprovincial Co-op

Active Ingredient: Maneb 50%

Formulations: Powder

Registered Use Claims:

Wheat - seed rot and seedling blights, bunt
Oats - seed rot and seedling blights, smut
Barley - seed rot and seedling blights, covered and false loose smut
Rye - seed rot and seedling blights, bunt
Flax - seed rot and seedling blights, damping off

Dosage:

	g product/25 kg seed
Wheat	26-40
Oats	69-92
Barley	50-66
Rye	28-43
Flax	112

10.6

Application Notes:

IPCO N-M : formulated for use as a drill box seed treatment or other dry treated methods.

See label for details.

Restrictions:

Do not use treated seed in feed or foodstuffs. If treated seed must be stored, label as follows: "Poisonous to man and animals. This seed has been treated with Name of Product containing maneb for the control of seed borne diseases."

Store treated seed away from feed and foodstuffs and always in a well ventilated place. Do not store treated seed more than 1 year.

Precautions:

Store away from children. May cause irritation of nose, throat, eyes and skin. Avoid inhalation of dust. In case of skin contact, wash with water. For eyes, get medical attention. Wear a dust mask for protection when handling seed treatment powder. If treatment is carried on indoors, thoroughly ventilate the area by mechanical exhaust. Do not mix with bare hands.

Storage:

Keep containers tightly closed when not in use. Keep away from fires and sparks. Store in a dry place. Do not allow to become wet or overheated during storage.

IPCO N-M D.P. Drill Box

Registrants: Interprovincial Co-op

Active Ingredients: Maneb 37.5%, lindane 18.75%

Formulation: Dust

Registered Use Claims:

Controls seed rot and seedling blight, and wireworms on wheat, oats, barley and rye. Controls bunt on wheat and rye, smut on oats and covered and false loose smut on barley.

Dosage:

	g product/25 kg seed
Wheat	- 52
Oats	- 92
Barley	- 65
Rye	- 56

Application Notes:

Formulated for use as a drill box treatment or for other dry treatment methods.

Restrictions:

If treated seed must be stored, label as follows: "Poisonous to man and animals. This seed has been treated with Name of Product containing lindane and maneb for the control of wireworms and seed-borne diseases. Do not use for feed or food." Do not store treated seed for more than one year. At the end of seeding, clean drill thoroughly and bury any dust or seed remaining.

Precautions:

Keep out of reach of children. Avoid skin contact, inhaling or swallowing dust. Wash thoroughly after handling or using and before eating or smoking. Wear a properly designed dust mask and goggles and change filters frequently while treating seed. Do not mix with hands. If treatment is carried on indoors, thoroughly ventilate the area by mechanical exhaust.

Storage:

Keep away from fire or sparks. Store in a dry place. Do not allow to become wet or overheated during storage, as this may impair effectiveness and cause flammable vapours.

Premiere Flowable Seed Treatment

Registrant: ICI Chipman

Active Ingredients: thiabendazole 1.6%, thiram 4.8%, lindane 40.0%.

Registered Use Claims:

Canola, mustard - seed-borne blackleg, pre-emergence damping off, seed decay, flea beetles.

Dosage: 700 mL per 25 kg seed. One 100 L drum treats 142 X 25 kg bags.

Application Notes:

Premiere is for use in liquid seed treating equipment. Best coverage is obtained when product is stored above 0°C before and during treating of seed.

Restrictions:

Label all unplanted, treated seed as follows: "Poisonous to man and animals. This seed has been treated with thiabendazole, thiram and lindane for the control of diseases and insects. Do not use as food or feed. Do not sell to oil mills."

Precautions:

Wear a respirator fitted for dust protection and goggles to avoid dust that may be present during bagging or bulk handling of treated seed. Wear rubber gloves, long sleeved clothing, goggles or safety glasses while handling product and treated seed. Keep out of reach of children. May be fatal if swallowed. May be harmful if dust arising from treated seed is inhaled. Wear a dust mask or respirator to exclude dust. Avoid contact with skin, eyes and clothing. Wash thoroughly after handling or using and before eating or smoking. Wash contaminated clothing before reuse. Do not consume alcoholic beverages immediately before or within 24 hours of working with thiram.

Storage: Store product in a cool, dry, well ventillated area away from food or feed and out of reach of children and animals. Keep product from freezing.

Mode of Action: Thiabendazole is a systemic fungicide which penetrates the seed to control disease within the seed and seedling, such as seed-borne blackleg, and aids in control of pre-emergence damping off and seed decay. Thiram is a contact fungicide which controls seed and soil diseases. Lindane is an organochlorine insecticide which works by ingestion, contact and fumigant action to give flea beetle control during germination and early emergence.

Other:

Premiere is fast drying, allowing for quicker bagging after treatment. Premiere is water based, providing good flowability and ease in cleanup.

Rovral Flo

Registrant: Rhone - Poulenc Canada Inc.

Active Ingredient: Iprodione 250 g/L

Formulation: Suspension

Registered Uses: Canola: Sclerotinia stem rot

Dosage: 2-3 L/ha (0.8-1.2 L/acre)

The higher rate is recommended for fields with a history of heavy disease pressure or for dense crop stands.

Water Volume: Ground Application: 100 L water/ha (40 L/acre)
Aerial Application: 45 L water/ha, minimum (18 L/acre)

Application and Timing:

Apply Rovral Flo when the crop is in the 20-30% bloom stage. For Argentine varieties, the correct stage for application is when 15-20 flowers are open (including small pods) on the main stem. For Polish varieties, the correct stage for application is when 11-15 flowers are open on the main stem.

Good coverage of the plants is essential. Do not reduce application rate or water volume. The crop must be treated at the recommended growth stage, or effectiveness will be reduced.

See label for mixing instructions and tips on aerial application.

Restrictions:

Do not store Rovral Flo near foodstuffs. Thoroughly clean application equipment after use. Do not contaminate domestic or irrigation water. Do not allow spray drift onto oats.

Precautions:

Keep out of reach of children. Avoid contact with skin and eyes. Wear protective gloves and coveralls when handling Rovral Flo. Wash hands and exposed skin thoroughly after handling the concentrate and after application. Avoid working in spray mist.

Storage: Protect from frost.

Mode of Action:

Rovral is essentially a contact fungicide. It is active on both spores and mycelium; because of this mode of action diseases are eradicated and plant material is protected against further infection.

Rovral ST

Registrant: Rhone - Poulenc Canada Inc.

Active Ingredient: Lindane 500 g/L, Iprodione 167 g/L

Formulation: Suspension

Registered Use Claims:

Canola - damping-off and root rot caused by Rhizoctonia solani; flea beetles; seed borne blackleg.

Dosage: 30 ml/kg of seed or 750 ml/25 kg seed.

Application: See label.
May be mixed with Counter 5-G or Furadan CR-10 at time of seeding.

Table 1: Seed Treatment Products for Use on Cereals and Oilseeds

Seed treatment products are poisonous. Pesticide poison symbols are placed on all container labels to indicate the toxicity of the product. Before using the product, read these symbols to determine its toxicity so that protective measures may be taken.

Pesticides are classified as follows:

- **DANGER POISON** — Very toxic
- **WARNING POISON** — Moderately toxic
- **CAUTION POISON** — Slightly toxic

No symbol appears on products having low toxicity.

	Products	Registrant	Chemicals	Toxicity	Formulation (1)	Registered Use Claims: Insects: Wireworms: Wheat	Oats	Barley	Rye	Flax	Flea Beetles: Canola	Mustard	Diseases: Blackleg: Canola	Seed & Seedling rot & Blights: Canola	Mustard	Wheat	Oats	Barley	Rye	Flax	Smuts carried on Seed: Rye-Bunt	Wheat-bunt	Oats-smut	Barley-covered	Barley-false loose	Rye-stem smut	Smuts in Seed: Wheat) loose smut	Barley)	Net Blotch: Barley	Leaf Strip: Barley	Common Root Rot: Cereals
Insecticides: 2)	Counter 5G	Cyanamid	terbufos		Gr						•	•																			
	Furadan CR-10	Chemagro	carbofuran		Gr						•	•																			
	Furadan 5G	Chemagro	carbofuran		Gr						•	•																			
Dual Purpose:	IPCO N-M. D.P. Drill Box	Interprov. Co-op	lindane; maneb		Du	•	•	•	•							•	•	•	•		•	•	•	•	•						
	Premiere Flowable	ICI Chipman	lindane; thiram; thiabendazole		Su						•	•	•	•	•																
	Thiralin—Plus	Rhone Poulenc	lindane; thiram; benomyl		Du						•		•	•																	
	Benolin—R	Interprov. Co-op	lindane; thiram; benomyl		Du						•		•	•																	
	Vitavax Dual Powder	Gustafson	lindane; thiram; carbathiin		Du	•	•	•	•	•						•	•	•	•	•		•	•	•	•	•	•	•			
	Vitavax Dual Solution	Gustafson	lindane; carbathiin		Sn	•	•	•	•							•	•	•				•	•	•	•	•	•	•	S	S	S
	Vitavax rs Powder	Gustafson	lindane; thiram; carbathiin		Du						•	•	•	•	•																
	Vitavax rs Flowable	Gustafson	lindane; thiram; carbathiin		Su						•	•	•	•	•																
	Rovral ST	Rhone Poulenc	lindane; iprodione		Su						•		•	•																	
Fungicides	IPCO N-M Drill Box	Interprov. Co-op	maneb		Du											•	•	•	•	•	•	•	•	•	•						
	Anchor	Gustafson	thiram; carbathiin	*	Su											•	•	•	•	•		•	•	•	•	•	•	•	S	S	S
	Vitavax Powder	Gustafson	thiram; carbathiin		Du														•	•		•	•	•	•	•	•	•			
	Vitavax Single Solution	Gustafson	carbathiin	*	Sn											•	•	•	•	•		•	•	•	•	•	•	•	S	S	S
	Formalin	United Agri Products	formaldehyde		Sn																	•	•	•	•						

1) **Formulation: Du - dust; Su - suspension; Sn - solution; WP - Wettable Powder; Gr - granulates.**
2) **For more information on insecticide seed treatments see the publication Field Crop Insect Control.**
* : Product registered for disease or insect control.
S : Product registered for disease suppression only.
* Concentration of active ingredient in this product does not warrant inclusion of toxicity warning symbol

Table 2: Foliar Fungicide Products for Use on Cereals and Oilseeds

Seed treatment products are poisonous. Pesticide poison symbols are placed on all container labels to indicate the toxicity of the product. Before using the product, read these symbols to determine its toxicity so that protective measures may be taken.

Pesticides are classified as follows:

- **DANGER POISON** — Very toxic
- **WARNING POISON** — Moderately toxic
- **CAUTION POISON** — Slightly toxic

No symbol appears on products having low toxicity.

Products	Registrant	Chemicals	Toxicity	Registered Use Claims																												
				Canola	Wheat, hard red spring & durum			Wheat, winter							Wheat, soft white spring and Canada Prairie spring							Barley										
				Sclerotinia stem rot	Leaf rust	Septoria leaf blotch	Tan spot	Leaf rust	Stem rust	Stripe rust	Powdery mildew	Septoria leaf spot	Septoria glume blotch	Tan spot	Leaf rust	Stem rust	Stripe rust	Powdery mildew	Septoria leaf spot	Septoria glume blotch	Tan spot	Leaf rust	Powdery mildew	Septoria leaf spot	Spot blotch	Net Blotch	Scald
Benlate	Dupont	benomyl	•	•																												
Rovral Flo	Rhone Poulenc	iprodione	CAUTION POISON	•																												
Bayleton	Chemagro	triadimefon	WARNING POISON					•	•	•	•																					
Dithane M-45	Rohm & Haas	mancozeb	•		•	•	•	•				•		•	•				•		•										
Tilt	Ciba Geigy	propiconazole	CAUTION POISON					•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

• No symbol appears on products having low toxicity.

Restrictions:

Do not use treated seed for feed, food or oil processing. Do not store Rovral ST near feed or foodstuffs. Do not contaminate feed or foodstuffs, or domestic or irrigation waters. Treated seed must be labelled as follows: "This seed has been treated with Rovral ST containing iprodione and lindane. Do not use for feed, food or oil processing." The date of treatment must also be included. Do not store treated seed for more than 6 months. Treated seed stored for more than 6 months should be tested for germination before planting. Store treated seed in cool, dry conditions. Leftover treated seed should not be stored where there is a chance of it becoming mixed with untreated seed. Thoroughly clean auger after handling treated seed before using same auger for handling commercial or feedgrains.

Precautions:

Keep out of reach of children. Avoid Contact With Skin And Eyes. Wear protective gloves and coveralls when handling Rovral ST or treated seed. When handling Rovral ST and when treating seed or while augering or handling treated seed, work in a well ventilated area and wear a suitable respirator. Wash hands and exposed skin thoroughly after handling or application.

Storage: Protect from frost.

Thiram 75 WP

Registrant: Gustafson

Active Ingredient: Thiram 75%

Registered Use Claims:

Alfalfa - Verticillium wilt. Controls seed rot and seedling blight or damping-off of peas, dry beans, soybeans, field corn, grasses and numerous vegetables.

Dosage:

Alfalfa, Verticillium wilt:	90 g/25 kg seed
Peas, beans, soybeans:	25-35 g/25 kg seed
Grasses:	90 g
Field corn:	30 g
Vegetables:	See Label

Application Notes:

Seed treatment may be applied as a powder or made into a slurry - See label for details.

Restrictions:

1. Label treated seed 'Do not use for food or feed. This seed has been treated with thiram'.
2. Do not graze treated areas or feed clippings from treated areas to livestock.

Precautions:

1. Keep out of reach of children.
2. Store in a cool, dry, ventilated place, away from feeds and foods.
3. Keep away from heat, fire and sparks.
4. May irritate eyes, nose throat and skin.
5. May cause allergic eczema in sensitive individuals.
6. Avoid contact with skin, eyes and clothing.
7. Wash thoroughly after handling and before eating, drinking or smoking.
8. Wash contaminated clothing with soap and hot water before reuse.
9. Do not consume alcoholic beverages for 24 hours before of after working with thiram.
10. Avoid breathing dust or spray mist. When treating, augering or handling treated seed, work in a well ventilated area and wear a suitable dust mask, goggles and gloves.
11. Do not contaminate food or feed.
12. Treated seed may be harmful to birds if ingested.
13. Do not contaminate any body of water.

Storage:

Store in a dry area. Do not store in or around the home. Do not store near food or feed.

Mode of Action:

Thiram is a contact fungicide which controls seed and soil borne diseases.

Thiram 320 Flowable

Registrant: Gustafson

Active Ingredients: Thiram 32.4%

Registered Use Claims: Alfalfa - Verticillium wilt

Dosage: 720 mL per 100 kg seed

Application Notes:

Do not dilute Thiram 320 with additional water. Add Thiram 320 to the seed and mix well for three minutes in treating equipment. Seed may be treated in cement mixer or commercially available seed treatment equipment. Thorough coverage of the seed is required.

Restrictions:

1. Keep out of reach of children.
2. May irritate eyes, nose, throat and skin.
3. May cause allergic eczema in sensitive individuals.
4. Avoid contact with skin, eyes and clothing.
5. Wash thoroughly after handling and before eating, drinking or smoking.

6. Wash contaminated clothing with soap and hot water before reuse.

7. Do not consume alcoholic beverages for 24 hours before or after working with Thiram 320.

8. Avoid breathing vapours.

9. When treating augering or handling treated seed, work in a well ventilated area and wear a suitable dust mask, goggles and gloves.

Precautions:

1. Label treated seed "Do not use for food or feed. This seed has been treated with thiram".

2. Do not contaminate food or feed.

3. Keep away from heat, fire and sparks.

4. Treated seed may be harmful to birds if ingested.

5. Do not contaminate any body of water.

Storage:

Store in a cool, dry, ventilated place away from feeds and foods. Do not store in or around the home.

Other:

Effects on Rhizobium inoculant: Thiram 320 is safe to Rhizobia. Apply inoculant immediately before seeding.

Tilt 250 E

Registrant: Ciba-Geigy Canada Limited

Active Ingredient: Propiconazole 250 g/L

Formulation: Emulsifiable concentrate

Registered Uses:

Winter wheat, Canada Prairie spring wheat, soft white spring wheat: controls leaf, stem and stripe rust, powdery mildew, tan spot, Septoria leaf spot and glume blotch. Barley: controls scald, net and spot blotch, powdery mildew, Septoria leaf spot and leaf rust.

Note:

In 1990 Tilt had a temporary restricted class registration. This registration has been extended to December 31, 1991.

Dosage: 500 mL/ha (200 mL/acre).

Water Volume: 200-400 L/ha (80-160 L/acre) for ground application, 40-50 L/ha (16-20 L/acre) for aerial application.

Application and Timing:

On wheat, apply Tilt when disease begins to develop at flag leaf emergence (Zadoks growth stage 37). A second application from just before ear emergence until the ear is one-half emerged (Zadoks 49-55) is required to provide season-long control if weather favours disease development.

For control of barley diseases, apply when disease begins to develop at the time of flag leaf emergence (Zadoks 37) until just before the ear is emerged (Zadoks 45-50).

If disease has not developed by flag leaf emergence in wheat or barley, only 1 late application is required.

Wind speed during aerial application should be less than 18 km/h to avoid drift. High humidity and low temperatures (10-20 C) allow for better deposition of spray droplets.

If rainfall occurs within 1 hour of application, re-application is necessary.

Restrictions:

Do not apply within 45 days of harvest. Do not feed straw from treated crops to livestock. Do not allow livestock to graze on treated crops.

Precautions:

Keep out of reach of children. Do not get in eyes, on skin or on clothing. Avoid breathing spray mist or vapours. Harmful if swallowed, inhaled or absorbed through the skin. Causes eye irritation. May cause skin sensitization in certain individuals.

Wear neoprene gloves, long sleeves and overalls when mixing or handling the product. Do not eat, drink or smoke during work; wash hands and face thoroughly before doing so. Immediately wash off accidental splashes of the concentrate or spray mixture from skin, clothing and out of eyes. Launder contaminated clothing before reuse. Do not contaminate food or feed. Do not contaminate any body of water. This pesticide is toxic to fish.

Mode of Action:

Propiconazole is a systemic fungicide. The active ingredient is absorbed by the leaves and stems and is transported upward in the plant into areas of new growth.

Propiconazole inhibits fungi by interfering with ergosterol biosynthesis, an essential part of the metabolism process in fungi.

Vitavax Dual Powder

Registrant: Gustafson

Active Ingredient: Carbathiin 20%, Thiram 28.9%, lindane 18.7%
Formulation: Dust

Registered Use Claims and Dosage Rate:

Treatment	Rate g/25 kg seed
Barley - False Loose, Covered and True Loose Smut and Wireworms	70
Wheat - True loose, Stinking Smut or Bunt and Wireworms	55-65
Oats - Loose and Covered Smut and Wireworms	95
Rye - Stem smut, seed decay and Wireworms	60
Flax - Damping-off, seed decay and Wireworms	70

Vitavax Dual Powder will generally increase emergence and plant stands of treated seeds by reducing seed-borne seed rots and seedling blights.

Application Notes:

Vitavax Dual Powder is applied to the seed when the drill or planter box is filled. See label for details.

Restrictions:

1. Do not use treated seed for feed, food or oil processing.

2. Do not contaminate feed or food-stuffs.

3. Do not graze or feed livestock on treated areas for 4 weeks after planting.

4. Do not store seed treated with Vitavax Dual Powder. Leftover treated seed should be double sown around the headland, or buried away from water source.

Precautions:

1. When handling Vitavax Dual Powder and treated seed, work in a well ventilated area.

2. Do not get on skin. Use rubber gloves when handling Vitavax Dual Powder or treated seed. In case of contact wash with warm water and soap.

3. Do not get into eyes. In case of contact with eyes, flush immediately with running water and seek medical attention.

4. Keep out of reach of children.

5. Alcoholic beverages should be avoided for 24 hours before or after working with Vitavax Dual Powder or treated seed.

Storage:

Do not store in or around home. Do not store near food or feed. Store in a cool, dry area.

Mode of Action:

Carbathiin is a systemic fungicide which penetrates the seed coat to control disease within the seed and seedling. Thiram is a contact fungicide which controls seed and soil diseases. Lindane is an organochlorine insecticide which acts by ingestion, contact and to a lesser extent, by fumigant action on soil dwelling and phytophagous insects.

Vitavax Dual Solution

Registrant: Gustafson

Active Ingredients: Carbathiin 180 g/L, lindane 165 g/L

Formulation: Solution

Registered Use Claims and Dosage Rate:
Treatment Rate mL/25 kg seed

Barley-False Loose, Covered, True Loose Smut & Wireworms	75 - 90**
Suppression of Leaf Stripe,*, Net Blotch* & Common Root Rot*.	
Wheat-True Loose Smut, Stinking Smut or Bunt & Wireworms. Suppression of Common Root Rot*.	75 - 90**
Oats-Loose & Covered Smut and Wireworms. Suppression of Common Root Rot*.	75
Rye-Stem smut, Wireworms. Suppression of common root rot.	75

*Seed Treatment will not protect post-seedling plants from infection.

**For wheat & barley varieties highly susceptible to true loose smut and for high levels of smut or bunt on seed, the 90 mL rate will give increased disease control.

Vitavax Dual Solution will generally increase emergence and plant stands by reducing seed-borne seed rots and seedling blights. This beneficial effect will allow treated seed to give increased yields for crops growing under stress conditions such as disease, cool weather and drought.

Application Notes:

Formulated for commercial treaters and on-farm auger treating. Uniform coverage at the correct rate is important for satisfactory results. Under treatment will lead to loss of efficacy and overtreatment could reduce germination. Refer to instructions supplied with your seed treater or to information supplied by Uniroyal Chemical for assistance with proper treating.

Restrictions:

1. Do not graze or feed livestock on treated areas for 4 weeks after planting.

2. Treated seed must be labelled as follows: 'This seed has been treated with Vitavax Dual Solution Seed Protectant - contains carbathiin and lindane; do not use for food, feed or oil processing.'

3. Do not contaminate feed or foodstuffs.

4. Do not contaminate ponds, lakes or streams.

5. Do not dilute with water.

Precautions:

1. Do not get into eyes. Wear goggles to protect from possible splashing.

2. Do not get onto skin. Use Butyl rubber gloves when handling Vitavax Dual or treated seed. Wash exposed areas thoroughly with soap and water after using and before eating or smoking.

3. Work in a well ventilated area when treating seed or while augering or handling treated seed and wear a suitable mask, gloves and goggles. Avoid breathing vapours.

4. Augers used for handling treated seed should not be used to move seed for feed food or oil processing.

5. Do not reuse bags from treated seed to handle food or feed products.

6. Keep out of reach of children.

7. Product is flammable. Keep away from sparks, flame and other sources of ignition.

8. Product may damage painted surfaces by removing paint or leaving red stain.

9. Polyethylene, polypropylene or nylon hose of appropriate pressure rating should be used for seed treatment application. Do not use rubber or PVC.

10. Solvent vapours given off during drying of treated seed may damage some plastics, rubber or painted surfaces.

11. Treat only clean, dust free seed to avoid the formation of lumps in treated seed.

Storage:

Do not store below 0°C. Do not store in or around home. Do not store near food or feed.

Other Comments:

1. Seed is protected by Vitavax as soon as it is treated.

2. Calibrate seeding equipment using treated seed to ensure proper seeding rate. Seed may be planted immediately.

3. Germination will not be affected by treatment when seed is properly stored. All seed carried from one year to the next, whether treated or untreated, should be checked for germination before planting.

Mode of Action:

Carbathiin is a systemic fungicide which penetrates the seed coat to control disease in the seed and seedling. Lindane is an organochlorine insecticide which acts by ingestion, contact and, to a lesser extent, by fumigant action on soil dwelling and phytophagous insects.

Vitavax Powder

Registrant: Gustafson

Active Ingredient: Carbathiin 26.7%, thiram 38.8%

Formulation: Dust

Registered Use Claims and Dosage Rates:
Treatment Rate: g/25 kg seed

Wheat - Loose smut, bunt	40 - 55
Barley - False loose smut, covered smut, true loose smut	50
Oats - Loose and covered smut	70
Rye - Stem smut, seed decay and damping-off	45
Flax - Damping-off, seed decay	60

Application Notes:

Formulated for use as a drill or planter box treatment. Thorough seed coverage is required. See label for details.

Restrictions:

1. Do not use treated seed for feed, food or oil processing.

2. Do not contaminate feed or foodstuffs.

3. Do not graze or feed livestock on treated areas for 4 weeks after planting.

4. Do not store seed treated with Vitavax Powder. Leftover treated seed should be double sown around the headland, or buried away from water sources.

Precautions:

1. When handling Vitavax Powder and when handling treated seed, work in a well ventilated area and wear a suitable dust mask, gloves and goggles.

2. Do not get into eyes. In case of contact with eyes, flush immediately with running water.

3. Avoid contact with skin. In case of contact, wash with warm water and soap.

4. Keep out of reach of children.

5. Because of possible unpleasant side effects, alcoholic beverages should be avoided for 24 hours before of after working with Vitavax Powder or treated seed.

Storage:

Do not store in or around home. Do not store near food or feed. Store in a cool, dry area.

Mode of Action:

Carbathiin is a systemic fungicide which penetrates the seed coat to control disease within the seed and seedling. Thiram is a contact fungicide which controls seed and seedling diseases.

Vitavax RS Flowable

Registrant: Gustafson

Active Ingredients: Carbathiin 45 g/L, thiram 90 g/L, lindane 680 g/L

Formulation: Liquid suspension

Registered Use Claims:

Canola - flea beetles, pre-emergence damping off, seed decay, seed- borne blackleg.

Mustard - seed decay, pre-emergence damping off, flea beetles.

Cole Crops - flea beetles

Dosage: 22.5 mL/kg seed

Application notes:

See label. May be used with batch treaters and cement mixers, or S-series treaters and OFT treaters available from Uniroyal Chemical.

Restrictions:

1. Do not use treated seed for feed, food or oil processing.

2. Do not contaminate feed or food-stuffs.

3. Do not graze or feed livestock on treated areas for 4 weeks after planting.

4. Do not contaminate ponds, lakes or streams.

5. Treated seed must be labelled as follows: 'This seed has been treated with Vitavax RS Flowable Seed Protectant (contains carbathiin, thiram and lindane). Do not use for feed or oil processing'.

6. Treated canola or mustard seed stored for periods in excess of 9 months may decrease in germination at a faster rate than untreated seed. Treated seed stored for more than 9

months should be tested for germination before planting. Do not store treated seed from cole crops (cabbage, califlower, brocolli, rutabagas and brussel sprouts).

7. Do not store treated seed above 25°C or in direct sunlight.

Precautions:

1. When handling Vitavax RS Flowable and treated seed work in a well ventilated area.

2. Do not get on skin. Use rubber gloves when handling Vitavax RS Flowable or treated seed. In case of contact wash with warm water and soap.

3. Do not get into eyes. The operator is advised to wear goggles to protect eyes. In case of contact with eyes, flush immediately with running water and seek medical attention.

4. Keep out of reach of children.

5. Because of possible unpleasant side effects, alcoholic beverages should be avoided for 24 hours before or after working with Vitavax RS Flowable or treated seed.

Storage:

Storage of Vitavax RS Flowable at low temperatures is not recommended. Due to the viscosity of the material, it should be kept above 10°C prior to and during application. Shake Well Before Using.

Mode of Action:

Carbathiin is a systemic fungicide which penetrates the seed coat to control disease within the seed and seedling. Thiram is a contact fungicide which controls seed and soil diseases. Lindane is an organochlorine insecticide which acts by ingestion, contact and to a lesser extent, by fumigant action on soil dwelling and phytophagous insects.

Vitavax RS Powder

Registrant: Gustafson

Active Ingredients: Carbathiin 3.3%, thiram 6.7%, lindane 50.0%

Formulation: Dust

Registered Use Claims:

Controls flea beetles, pre-emergence damping-off and seed decay of rapeseed and mustard. Controls seed-borne blackleg of rapeseed.

Dosage: 750 g product per 25 kg seed.

Application Notes:

Can be applied to seed when the drill box is filled. See label for details. Uniform coverage is necessary.

Restrictions:

1. Do not use treated seed for feed, food or oil processing.

2. Do not contaminate feed or foodstuffs.

3. Do not graze or feed livestock on treated areas for 4 weeks after planting.

4. Do not contaminate ponds, lakes or streams.

5. Treated seed must be labelled as follows: "This seed has been treated with Vitavax RS Powder (contains carbathiin, thiram and lindane). Do not use for feed or oil processing."

6. Do not store seed treated with Vitavax RS Powder. Leftover treated seed should be double sown around the headland, or buried away from water sources.

Precautions:

1. When handling Vitavax RS Powder and treated seed, work in a well ventilated area.

2. Do not get on skin. Use rubber gloves when handling Vitavax RS Powder or treated seed. In case of contact wash with warm water and soap.

3. Do not get into eyes. The operator is advised to wear goggles to protect eyes. In case of contact with eyes, flush immediately with running water and seek medical attention.

4. Keep out of reach of children.

5. Because of possible unpleasant side-effects, alcoholic beverages should be avoided for 24 hours before of after working with Vitavax Powder or treated seed.

Storage:

Do not store in or around home. Do not store near food or feed. Store in a cool, dry area.

Mode of Action:

Carbathiin is a systemic fungicide which penetrates the seed coat to control disease within the seed and seedling. Thiram is a contact fungicide which controls seed and soil diseases. Lindane is an organochlorine insecticide which acts by ingestion, contact and to a lesser extent, by fumigant action on soil dwelling and phytophagous insects.

Vitavax Single Solution

Registrant: Gustafson

Active Ingredient: Carbathiin 230 g/L

Formulation: Solution

Registered Use Claims and Dosage Rate:
Treatment Rate mL/25 kg seed

Barley - False Loose, Covered, True Loose Smut Suppression of Leaf Stripe,*, Net Blotch* & Common Root Rot*	60-75*
Wheat - True Loose Smut, Stinking Smut or Bunt Suppression of Common Root Rot*.	60-75*
Oats - Loose & Covered Smut and Wireworms Suppression of Common Root Rot*	60
Rye - Stem smut. Suppression of Common Root Rot*	60
Flax - Damping-off and seed decay	100

*Seed Treatment will not protect post-seedling plants from infection.

**For wheat & barley varieties highly susceptible to true loose smut and for high levels of smut or bunt on seed, the 75 mL rate will give increased disease control.

Vitavax Single Solution will generally increase emergence and plant stands by reducing seed-borne seed rots and seedling blights. This beneficial effect will allow treated seed to give increased yields for crops growing under stress conditions such as disease, cool weather and drought.

Application Notes

Formulated for commercial treaters and on-farm auger treating. Uniform coverage at the correct rate is important for satisfactory results. Under treatment will lead to loss of efficacy. Refer to instructions supplied with your seed treater or to information supplied by Uniroyal Chemical for assistance with proper treating.

Restrictions:

1. Do not graze or feed livestock on treated areas for 4 weeks after planting.
2. Treated seed must be labelled as follows: 'This seed has been treated with Vitavax Single Solution Seed Protectant - contains carbathiin; do not use for food, feed or oil processing.'
3. Do not contaminate feed or foodstuffs.
4. Do not contaminate ponds, lakes or streams.
5. Do not dilute with water.

Precautions:

1. Do not get into eyes. Wear goggles to protect from possible splashing.
2. Do not get onto skin. Use Butyl rubber gloves when handling Vitavax or treated seed. Wash exposed areas thoroughly with soap and water after using and before eating or smoking.
3. Work in a well ventilated area when treating seed or while augering or handling treated seed and wear a suitable mask, gloves and goggles. Avoid breathing vapours.
4. Augers used for handling treated seed should not be used to move seed for feed food or oil processing.
5. Do not reuse bags from treated seed to handle food or feed products.
6. Keep out of reach of children.
7. Product is flammable. Keep away from sparks, flame and other sources of ingnition.
8. Product may damage painted surfaces by removing paint or leaving red stain.
9. Polyethylene, polypropylene or nylon hose of appropriate pressure rating should be used for seed treatment application. Do not use rubber of PVC.
10. Solvent vapours given off during drying of treated seed may damage some plastics, rubber or painted surfaces.

Storage:

Do not store below 0°C. Do not store in or around home. Do not store near food or feed.

Other Comments:

1. Seed is protected by Vitavax as soon as it is treated. (Seed may be planted immediately.)
2. Calibrate seeding equipment using treated seed to ensure proper seeding rate.
3. Germination will not be affected by treatment when seed is properly stored. All seed carried from one year to the next, whether treated or untreated, should be checked for germination before planting.

Mode of Action:

Carbathiin is a systemic fungicide which penetrates the seed coat to control disease in the seed and seedling.